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**A Longitudinal Study of the Relationship  
Between Lifestyle and Mental Health Among  
Midlife and Older Women in Australia: Findings  
From the Healthy Aging of Women Study**

Qunyan Xu, Mary Courtney, and Debra Anderson

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*Qunyan Xu, Mary Courtney, and Debra Anderson*

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1       **A Longitudinal Study of the Relationship**  
2       **Between Lifestyle and Mental Health Among**  
3       **Midlife and Older Women in Australia: Findings**  
4       **From the Healthy Aging of Women Study**

5       QUNYAN XU, MARY COURTNEY, and DEBRA ANDERSON

6       *Institute of Health and Biomedical Innovation, Queensland University of Technology,*  
7       *Kelvin Grove, Brisbane, Australia*

8       *We investigated the temporal relationship between lifestyle and*  
9       *mental health among 886 midlife women. The mental health mea-*  
10       *sured included anxiety, depression, and mental well-being; the*  
11       *lifestyle measured included body mass index (BMI), exercise, smok-*  
12       *ing, alcohol use, and caffeine consumption. We found that BMI*  
13       *was positively related with mental well-being ( $r = .316$ ,  $p = .009$ );*  
Q1 14       *smokers had lower mental well-being than nonsmokers ( $? = 6.725$ ,*  
15        *$p = .006$ ), and noncaffeine drinkers had higher mental well-being*  
16       *( $? = 5$ ,  $p = .023$ ). Past alcohol-drinkers had less anxiety than*  
17       *nondrinkers ( $? = 1.135$ ,  $p = .04$ ). Therefore, lifestyle is predictive*  
18       *of mental health among midlife women.*

19       Unhealthy lifestyle choices have an established association for women in the  
20       development of chronic disease such as cardiovascular disease and type 2  
21       diabetes (Li et al., 2006; Shai et al., 2006). Although the relationship between  
22       lifestyle and physical health has been studied extensively, little currently is  
23       known about how lifestyle choices impact on the mental health of women.  
24       Understanding this association is essential to help facilitating planning of  
25       effective lifestyle programs and guidelines for women.

26       Unhealthy lifestyle, including being overweight/obese, physical inac-  
27       tivity, smoking, alcohol overconsumption, and unhealthy diet, contribute

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28 substantially to the burden of disease. In Australia, 48% of men and 30% of  
29 women are overweight, and obesity affects a further 19% of men and 22%  
30 of women, with a direct health cost of \$830 million (Thorburn, 2005). More  
31 than 60% of Australian adults do not perform adequate physical activity to  
32 maintain their health, which consequently accounts for about 6.0% of the to-  
33 tal disease and injury burden (Bauman & Owen, 1999). Smoking still remains  
34 the leading preventable cause of death in the world, and it is responsible  
35 for 7.8% of the Australian total disease and injury burden (Social Research  
36 Center, 2006). Despite the well-documented impact of unhealthy lifestyles  
37 on the Australian populations' physical health, which costs the health system  
38 significantly, knowledge about the relationship between lifestyle and mental  
39 health remains limited.

40 Several cross-sectional studies have been undertaken in this regard  
41 (Bonnet et al., 2005; Rohrer, Pierce, & Blackburn, 2005), and researchers  
42 illustrated a positive correlation between lifestyle and mental health. Due  
43 to the nature of cross-sectional design, however, it is impossible to predict  
44 whether people living with an unhealthy lifestyle are more likely to have a  
45 poor status of mental health in the future. Our literature search also identified  
46 several prospective studies examining the temporal relationship between  
47 a single lifestyle factor and mental health. For instance, relationships be-  
48 tween baseline obesity and depression and anxiety (Kasen, Cohen, Chen, &  
49 Must, 2008; Roberts, Deleger, Strawbridge, & Kaplan, 2003; Roberts, Kaplan,  
50 Shema, & Strawbridge, 2000), physical activity and depression (Brown, Ford,  
51 Burton, Marshall, & Dobson, 2005; Strawbridge, Deleger, Roberts, & Kaplan,  
52 2002), smoking and depression (Murphy et al., 2003; Takeuchi, Nakao, &  
53 Yano, 2004), alcohol with depression, and anxiety (Haynes et al., 2005) all  
54 have been found. Few studies, however, have explored the relationship of  
55 multiple lifestyles with mental health, as they tend to focus on one lifestyle  
56 factor only.

57 Researchers have found that lifestyle conditions correlated with one an-  
58 other, such as being overweight/obese and physical activity (Stamatakis,  
59 Hirani, & Rennie, 2009), extra weight gain and alcohol consumption  
60 (Wannamethee & Shaper, 2003), an inverse relationship between physical  
61 activity and smoking (Kaczynski, Manske, Mannell, & Grewal, 2008), and the  
62 cooccurrence of smoking and alcohol (Degenhardt & Hall, 2003). Unhealthy  
63 lifestyles often are combined together in one individual, with 60% of the  
64 populations having two or more unhealthy lifestyle factors (Fine, Philogene,  
65 Gramling, Coups, & Sinha, 2004; Poortinga, 2007). Based on the evidence,  
66 we proposed the following hypothesis: each lifestyle factor has a different  
67 correlation with mental health both in terms of magnitude and direction,  
68 and their associations with mental health can be influenced by one another.  
69 Therefore, the goal of this study was to determine the different effects of  
70 lifestyle on mental health through a longitudinal prospective approach.

## 71 METHODS

## 72 Design

73 The study is part of the Healthy Ageing of Women Study (HOW), which  
74 is a prospective, cross-cultural study comparing the lifestyles of Australian  
75 and Japanese midlife women as they age. The current study is based on the  
76 Australian database.

## 77 Sample

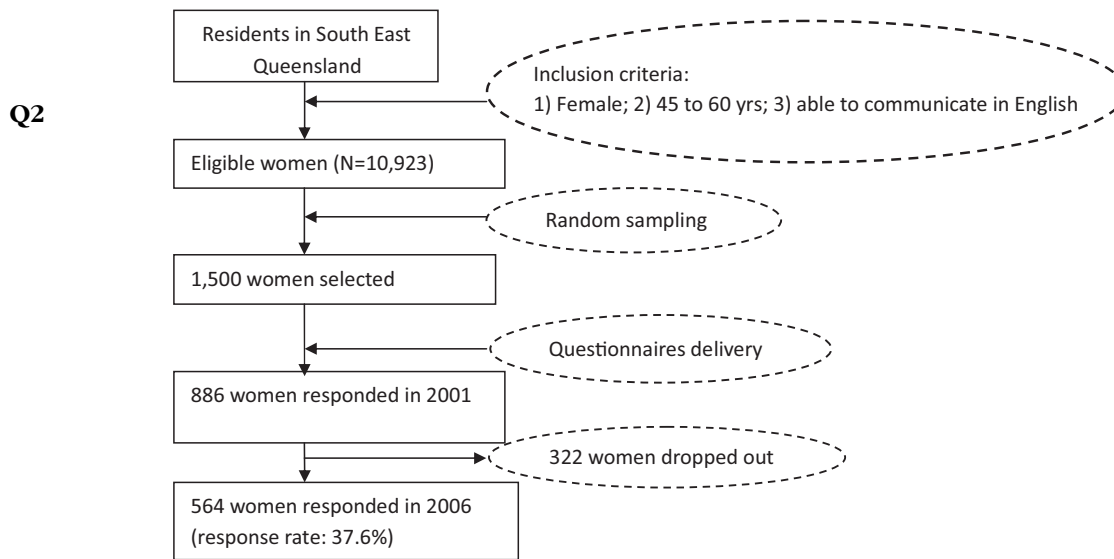
78 We recruited women from the general community in six postcode areas in  
79 South East Queensland, Australia, with a balanced study population from  
80 rural and urban areas. In this article we report the findings about the rela-  
81 tionship between lifestyle and mental health from analysis of the Australian  
82 branch at two time waves: 2001 (time 1) and 2006 (time 2). The inclusion  
83 criteria of the study follow: (1) female; (2) 45 to 60 years of age; and (3) able  
84 to communicate in English. This initial procedure identified 10,923 women,  
85 and, from this, 1,500 women were randomly invited to participate in this  
86 study. In the final analysis, 886 women agreed to participate at time 1, with  
87 a response rate of 59%. Baseline recruitment details also are available in  
88 an earlier publication by Anderson, Yoshizawa, Gollschewski, Atogami, and  
89 Courtney (2004). The second wave of questionnaires were delivered to these  
90 women in 2006, with 564 questionnaires completed and returned. Therefore,  
91 the final response rate was 7.6%. Among the women not replying, two went  
92 overseas, three were deceased, 28 did not wish to participate, 104 changed  
93 addresses, a further 13 could not be traced, and an additional 172 did not  
94 reply. The details of the recruiting process are shown in the flow chart (see  
95 Figure 1).

96 The Queensland University of University Human Research Ethics Com-  
97 mittee approved this study.

## 98 Measures

99 *Social demographics.* Age, marital status, country of birth, ethnic ori-  
100 gin, language spoken at home rather than English, education, employment  
101 status, and annual family income were collected.

102 *Lifestyle predictors.* Body mass index (BMI) was calculated with self-  
103 reported height and weight. The current World Health Organization (WHO)  
104 cut-off point of BMI is widely accepted as a standard to identify obesity, with  
105 a BMI from 25.0 to 29.9 as overweight, and BMI  $\geq 30$  as obese (WHO, 2000).  
106 In this study, however, BMI was analyzed as a continuous variable based  
107 on the following statistical considerations: (a) treating BMI as a continuous



**FIGURE 1** Sample recruitment.

108 variable increases precision of results due to greater power; (b) results will be  
 109 more informative than using categorical variable and are easier to interpret;  
 110 and (c) the model will have greater parsimony (Lazic, 2008).

111 Physical activity was measured by asking the women, “how often do you  
 112 exercise (including tai chi, fitness, yoga, walking, swimming) every week to  
 113 improve your health?” Four options including “none,” “1–2 times/week,” “3–  
 114 4 times/week,” and “5–6 times/week” were provided for women to indicate  
 115 their level of exercise.

116 For the purpose of this study, the intensity and the duration of exercise  
 117 were not measured.

118 Alcohol use was evaluated by asking women, “Have you ever drunk  
 119 alcohol-containing beverages?” Four choices were given, which were  
 120 “never,” “drank in the past,” “occasionally,” and “regularly.”

121 Smoking status was determined by asking women, “Do you currently  
 122 smoke at all,” followed by three options including “never,” “past,” and “cur-  
 123 rent smoker.”

124 Caffeine consumption was recorded as “yes” or “no,” and the amount  
 125 of caffeine was not measured.

126 *Mental health outcomes: Psychological symptoms & mental well-being.*  
 127 Mental health was assessed in this study by two separate measurement  
 128 scales that measured general mental well-being and psychological symptoms  
 129 including depression and anxiety. General mental well-being was measured  
 130 by the mental health component of the Medical Outcomes Study Short-Form  
 131 36 (SF-36-MH; McCallum, 1995; Ware & Sherbourne, 1992). The SF-36 is

132 a widely used quality of life measurement. Transformation of raw scores  
133 was used in analysis. The score ranges from 0 to 100, with a higher score  
134 indicating better mental health status.

135 Psychological symptoms including depression and anxiety were as-  
136 sessed by the psychological subscale of the Greene Climacteric Scale (GCS).  
137 The GCS is a self-report questionnaire that measures a total of 21 physical,  
138 psychological, and vasomotor symptoms associated with the menopause  
139 transition. Each item is rated by the participant according to its severity us-  
140 ing a 4-point scale ranging from 0 (a little) to 3 (extremely). Calculation of  
141 the psychological scale is the sum of symptoms from 1 to 11. The psycho-  
142 logical scale can be further subdivided to give measures of anxiety: sum of  
143 items 1–6; and depression: sum of items 7–11. The test–retest reliability for  
144 the psychological scale is 0.87 (Greene, 1998).

145 *Menopause status.* Menopause status was identified by asking women  
146 questions about their menstruation period: “Have you had a hysterectomy,  
147 an operation to remove your uterus or womb”; “Have you had both ovaries  
148 removed”; “Have you had a menstrual period in the past 12 months”; “Have  
149 you had a menstrual period in the past 3 months”; and “Compared to a  
150 year ago, has the number of days between menstrual periods become less  
151 predictable?” Women’s menopausal status was thus classified into four cate-  
152 gories accordingly: (1) perimenopause: irregular menstruation over previous  
153 year but had menstruated in past 3 months, or irregular menstruation over  
154 previous year but no menstruation in past 3 months; (2) premenopausal:  
155 no irregularity in their periods in the previous 12 months and menstruating  
156 in the previous 3 months; (3) postmenopause: no menses for 12 or more  
157 months without having a hysterectomy and ovaries removed; (4) surgical  
158 menopause: having hysterectomy or ovaries removed.

## 159 Analysis

160 SPSS version 16.0 was used for data management and analysis. In a multiple  
161 linear regression analysis, we defined mental outcomes as the dependent  
162 variables, and lifestyle factors as the independent variables. A descriptive  
163 data analysis was conducted. Characteristics of women lost to 5-year follow-  
164 up were compared with women who completed both waves of the study, in  
165 order to examine whether the loss to follow-up women were different from  
166 those who completed the study. Compared characteristics were as follows:  
167 sociodemographic factors, lifestyles, mental health status, and menopausal  
168 status. Longitudinal analysis in this article was confined to women who  
169 completed both studies; thus, the number of women used in the analysis  
170 was 564.

171 To estimate the coefficients of different lifestyles in the relationship with  
172 mental health, the mental health score at 5 years was used as the dependent

173 variable and baseline lifestyles as the independent variable. Also, baseline  
174 mental health was treated as an independent variable. A  $p$  value of 0.05 or  
175 less was considered to be statistically significant.

176 If mental health was not influenced by lifestyle factors, a paired  $t$  test  
177 would be conducted to compare times 1 and 2 mental health statuses; oth-  
178 erwise, repeated measures analysis of variance (ANOVA) would be used to  
179 test the interaction effect of time and lifestyle factors on mental health.

180

## RESULTS

### 181 Descriptive Information

182 The mean age of the women was 55 years (SD = 2.82; refer to Table 1). Of  
183 the women, 76.2% were married or in de facto relationship; 82.3% were born  
184 in Australia; 97.9% were nonindigenous; 28.6% were college educated; about  
185 40% did not have paid employment; 42.7% had family annual income less  
186 of than \$40,000; and 78.1% were postmenopausal (48.3% natural and 29.8%  
187 surgical). Concerning women's lifestyle, 18.1% of women did not exercise,  
188 61.1% never smoked, 56.8% occasionally drank alcohol, and the majority  
189 consumed caffeine-containing beverages. The mean score for anxiety was  
190 3.62 (SD = 2.88), depression was 3.10 (SD = 2.65), psychological symptoms  
191 was 6.67 (SD = 5.08), and SF-36-MH was 75.69 (SD = 17.38).

192 For women aged from 50 to 59 years, the Australian norm value of GCS  
193 psychological subscale was 3.0 for anxiety, 3.0 for depression, and 6.0 for  
194 psychological symptoms (Travers, O'Neill, King, Battistutta, & Khoo, 2005).  
195 In order to compare the current sample with the Australian norm value, the  
196 median value of psychological symptoms was calculated. The median values  
197 are as follows: 3.0 for anxiety, 2.0 for depression, and 6.0 for psychological  
198 symptoms. These results were very similar to the norm.

199 No significant differences were found between women who completed  
200 the study and those who dropped out, with the only exception of age (refer  
201 to Table 1). Women who were lost to follow-up ( $54.36 \pm 2.87$  years) were  
202 slightly younger than those who remained ( $54.95 \pm 2.76$  years) in the study  
203 ( $p = .003$ ). Although the difference was statistically significant, the absolute  
204 difference of less than 1 year is too small to impact the results of interest;  
205 therefore, we considered that time 2 women were representative of the study  
206 population at time 1.

### 207 The Relationship Between Lifestyle Factors and Mental 208 Health at Baseline

209 Body mass index (BMI) was significantly related to depression ( $r = .066$ ,  $p =$   
210  $.002$ ), psychological symptoms ( $r = .086$ ,  $p = .037$ ), and mental well-being  
211 ( $r = -.487$ ,  $p = .001$ ; refer to Table 2). Specifically, 10 units increase in BMI  
212 resulted in a 0.66 point increase in the depression score, 0.86 point elevation



**TABLE 1** Descriptive Analysis of Demographic Factors; a Comparison Between Years 2001 and 2006

Variables	Total (N = 886)	Completed (N = 564)	Dropouts (N = 322)	<i>p</i>
Age	54.73 ± 2.82	54.95 ± 2.76	54.36 ± 2.87	.003
BMI	27.04 ± 5.89	27.09 ± 5.66	26.95 ± 6.27	.743
Marital status				.226
Married	670 (76.2)	438 (78.1)	232 (73.0)	
Separate	111 (12.6)	65 (11.6)	46 (14.5)	
Single	98 (11.1)	58 (10.3)	40 (12.6)	
Country of birth				.462
Australia	723 (82.3)	466 (83.1)	257 (81.1)	
Other	155 (17.7)	95 (16.9)	60 (18.9)	
Aboriginal				1.000
Yes	19 (2.1)	12 (2.1)	7 (2.2)	
No	867 (97.9)	553 (97.9)	314 (97.8)	
Speak English at home				.585
Yes	62 (7.1)	37 (6.7)	25 (7.8)	
No	813 (92.9)	518 (93.3)	295 (92.2)	
Education				.791
<=junior	462 (52.7)	295 (52.8)	167 (52.5)	
Senior high	138 (15.7)	86 (15.4)	52 (16.4)	
Uni./Tech	251 (28.6)	159 (28.4)	92 (28.9)	
Other	26 (3.0)	19 (3.4)	7 (2.2)	
Employment				.612
Full time	268 (32.1)	174 (32.4)	94 (31.6)	
Part time	233 (27.9)	144 (26.8)	89 (30.0)	
Unpaid	333 (39.9)	219 (40.8)	114 (38.4)	
Income				.197
<=\$40,000	378 (42.7)	236 (41.8)	142 (44.2)	
>\$40,000	358 (40.4)	240 (42.5)	118 (36.8)	
Don't know	150 (16.9)	89 (15.8)	61 (19.0)	
Menopause status				.494
Pre-	60 (6.8)	41 (7.3)	19 (6.0)	
Peri	132 (15.1)	85 (15.2)	47 (14.8)	
Postmenopause	423 (48.3)	276 (49.4)	147 (46.4)	
S-menopause	261 (29.8)	157 (28.1)	104 (32.8)	
Physical activity				.413
None	145 (18.1)	86 (16.8)	59 (20.3)	
1-2 times/w	239 (29.8)	154 (30.0)	85 (29.3)	
3-4 times/w	240 (29.9)	151 (29.4)	89 (30.7)	
5-6 times/w	179 (22.3)	122 (23.8)	57 (19.7)	
Smoking				.989
None	533 (61.1)	340 (61.2)	193 (61.1)	
Past	244 (28.0)	156 (28.1)	88 (27.8)	
Current	95 (10.9)	60 (10.8)	35 (11.1)	
Alcohol				.584
None	186 (21.3)	125 (22.4)	61 (19.2)	
Abstainer	40 (4.6)	24 (4.3)	16 (5.0)	
Occasional	497 (56.8)	317 (56.8)	180 (56.8)	
Regular	152 (17.2)	92 (16.5)	60 (18.9)	
Caffeine				.110
Yes	786 (90.9)	511 (92.1)	275 (88.7)	
No	79 (9.1)	44 (7.9)	35 (11.3)	
Psychological symptoms				.293
Anxiety	6.67 ± 5.08	6.53 ± 5.01	6.92 ± 5.20	.240
Depression	3.62 ± 2.88	3.54 ± 2.89	3.78 ± 2.89	.263
SF-36-MH	3.10 ± 2.65	3.03 ± 2.58	3.25 ± 2.78	.284
	75.69 ± 17.38	76.17 ± 17.28	74.84 ± 17.56	

**TABLE 2** Correlations Between Lifestyles Factors and Time 1 Mental Health After Adjustment for Sociodemographic Factors and Menopausal Status

	Anxiety	Depression	Psychological symptoms	SF-36-MH
BMI	.027	.066**	.086*	-.487***
Physical activity				
None	Ref	Ref	Ref	Ref
1–2 times/w	0.082	0.255	0.397	2.376
3–4 times/w	-0.516	-0.386	-0.923	5.672*
5–6 times/w	-1.023	-1.192***	-2.276**	8.626***
Smoking				
Never	Ref	Ref	Ref	Ref
Past	0.283	0.187	0.482	-0.123
Current	0.163	0.404	0.395	-0.737
Alcohol				
Never	Ref	Ref	Ref	Ref
Pastdrinker	0.144	-0.773	-1.003	0.568
Occasionally	0.261	-0.412	-0.173	0.193
Regularly	0.187	-0.308	-0.304	-1.436
Caffeine				
Yes	Ref	Ref	Ref	Ref
No	-0.068	0.180	0.464	-1.187

\* $p < .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$ .

213 in the psychological score, and 4.87 points decrease in the mental well-being  
 214 score. Women who exercise 5–6 times per week were 1 point lower in the  
 215 anxiety score ( $p = .013$ ), 1 point less in the depression score ( $p = .001$ ),  
 216 2 points lower in the psychological score ( $p = .002$ ), and 9 points higher in  
 217 the mental well-being score ( $p = .001$ ), when compared with women who  
 218 did not exercise. Alcohol use, caffeine consumption, and smoking, how-  
 219 ever, were not significantly correlated with anxiety, depression, psychologi-  
 220 cal symptoms, and mental well-being. Menopausal status had no relationship  
 221 with anxiety, but it was related to depression and psychological symptoms.  
 222 Postmenopausal women had less depression than premenopausal women  
 223 ( $p = .007$ ), and both peri- ( $p = .034$ ) and postmenopausal women ( $p = .046$ )  
 224 had fewer psychological symptoms when compared with premenopausal  
 225 women.

## 226 Prospective Relationship Between Lifestyle Risk Factors 227 and Mental Health

228 Longitudinally (see Table 3), BMI was positively related with the time 2 men-  
 229 tal well-being score. A coefficient of 0.316 indicated that a 10 unit increase  
 230 in BMI would result in a 3-point improvement in the SF-36-MH score. The  
 231 direction of this relationship was different from that of the baseline data.  
 232 Women who smoked had a 6.725 point lower score of mental well-being

**TABLE 3** Correlations Between Lifestyle Factors and Time 2 Mental Health After Adjustment for Sociodemographic Factors, Menopausal Status, and Time 1 Mental Health

	Anxiety	Depression	Psychological symptoms	SF-36-MH
BMI	-.013	.003	-.008	.316**
Physical activity				
None	Ref	Ref	Ref	Ref
1–2 times/w	0.056	–0.319	–0.256	1.234
3–4 times/w	–0.138	–0.371	–0.490	1.528
5–6 times/w	–0.204	0.068	–0.215	1.031
Smoking				
Never	Ref	Ref	Ref	Ref
Past	0.079	–0.088	–0.003	1.231
Current	–0.314	0.435	0.047	–6.725**
Alcohol				
Never	Ref	Ref	Ref	Ref
Pastdrinker	–1.135*	0.647	–0.296	–0.999
Occasionally	–0.232	0.113	–0.041	–1.457
Regularly	0.004	0.009	0.222	–2.735
Caffeine				
Yes	Ref	Ref	Ref	Ref
No	–0.225	–0.496	–0.623	4.989*

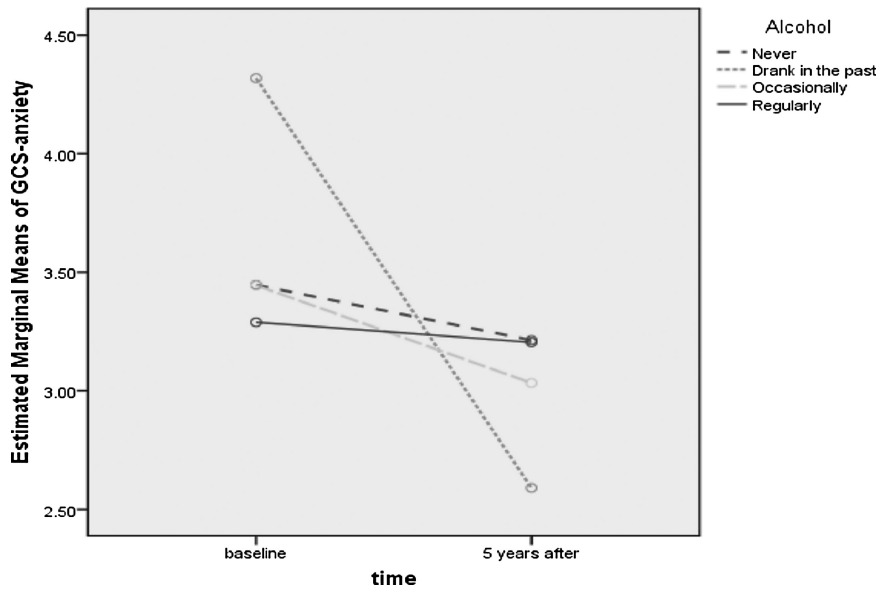
\* $p < .05$ ; \*\* $p \leq .01$ ; \*\*\* $p \leq .001$ .

233 than nonsmokers ( $p = .006$ ), and women who consumed caffeine drinks  
 234 regularly reported lower mental well-being (5 points), when compared with  
 235 noncaffeine drinkers ( $p = .037$ ). In terms of alcohol use, women who were  
 236 past alcohol drinkers had lower anxiety scores (1.135 points) when compared  
 237 with nondrinkers ( $p = .040$ ), and no effect was observed among occasional  
 238 and regular drinkers. No effect of menopausal status on time 2 mental health  
 239 was found.

240 These interaction effects of time and alcohol use on anxiety, time and  
 241 smoking, and caffeine consumption on mental well-being also are plotted in  
 242 Figures 2, 3, and 4. Since depression and psychological symptoms were not  
 243 affected by any of the measured lifestyle factors, a paired  $t$  test was used to  
 244 compare the mean. As shown in Table 4, women's depression and psycho-  
 245 logical scores decreased over the follow-up period, with the improvement  
 246 of psychological symptoms being statistically significant ( $p = .001$ ).

**TABLE 4** Paired  $t$  test of Depression and Psychological Symptoms Between Baseline and 5 Years

Variables	Baseline	5 years	Mean difference	$t$	$p$
Psychological symptoms	6.35 ± 4.93	5.75 ± 4.59	0.60 ± 3.90	3.302	.001
Depression	3.00 ± 2.58	2.81 ± 2.46	0.19 ± 2.23	1.888	.060

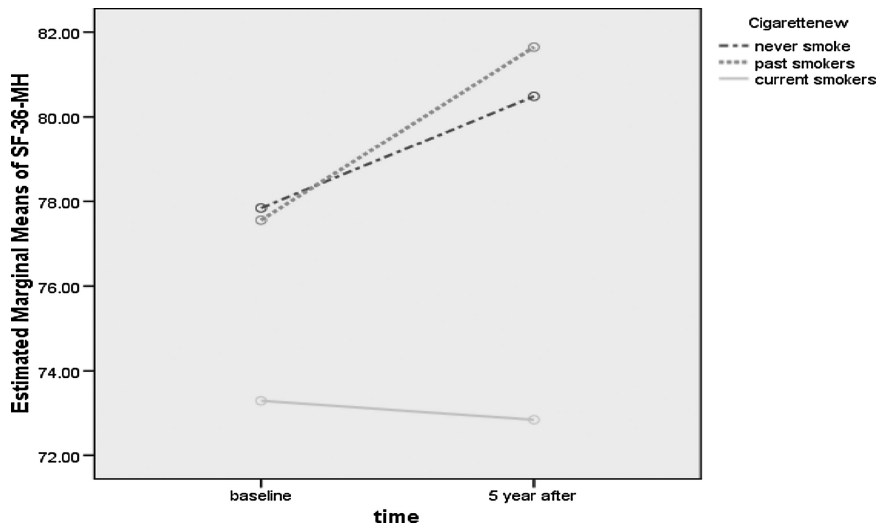


**FIGURE 2** The mean anxiety score for different alcohol consumption groups, baseline and 5 years after.

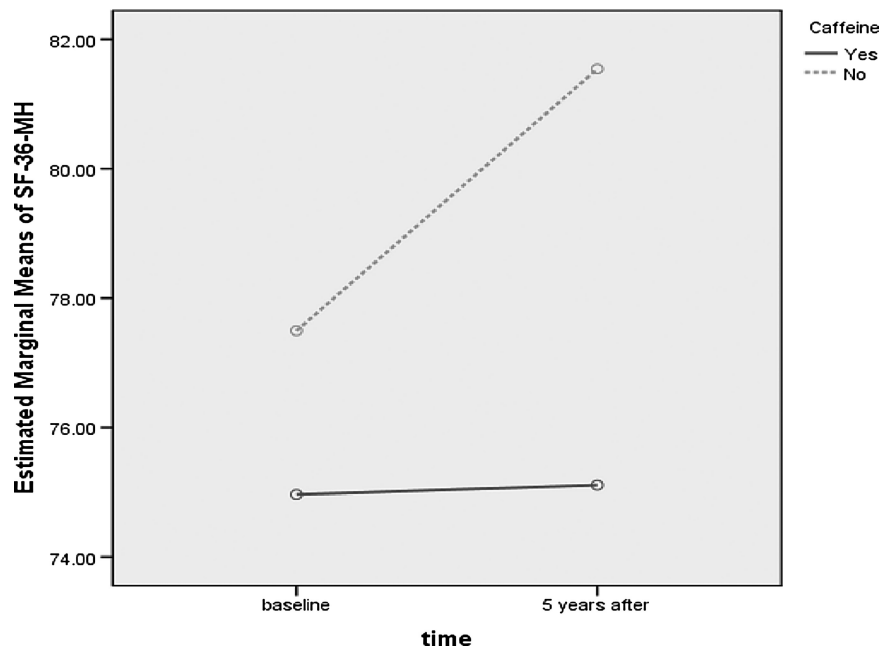
247

### DISCUSSION

248 Having done a prospective study, we found that women with higher BMI  
 249 have better mental well-being, and past drinkers have less anxiety 5 years  
 250 later. Women who smoke and consume caffeine are more likely to result



**FIGURE 3** The mean mental well-being score for different smoking groups, baseline and 5 years after.



**FIGURE 4** The mean mental well-being score for different caffeine groups, baseline and 5 years after.

251 in a low level of mental well-being. The study also found that as Australian  
 252 women age, they have less depression. Physical activity has no relationship  
 253 with either mental well-being or psychological symptoms, although a trend  
 254 toward significant was apparent.

255 Consistent with other longitudinal studies (Kinnunen et al., 2006;  
 256 Klungsoyr, Nygard, Sorensen, & Sandanger, 2006), we found current smok-  
 257 ers were more likely to experience worse mental health relevant to never  
 258 and past smokers. A reciprocal interaction between smoking and depression  
 259 was proposed (Paperwalla, Levin, Weiner, & Saravay, 2004) and identified  
 260 that depression may be a vulnerability factor for smoking initiation among  
 261 youngsters, and smoking may be associated with the development of de-  
 262 pression because of nicotine's neurophysiologic effect.

263 The effect of caffeine consumption on mood has not been conclusive  
 264 (Casas, Ramos-Quiroga, Prat, Qureshi, & Nehlig, 2004), with more studies  
 265 finding that caffeine had a positive effect on mental health as a sensation of  
 266 well-being. We discovered, however, a long-term negative impact of caffeine  
 267 consumption on mental health among midlife women. The results from our  
 268 study are supported from the findings of an earlier study by Veleber and  
 269 Templer (1984), who demonstrated that caffeine increased depression, anx-  
 270 iety, and hostility among healthy people, after adjusting for their caffeine  
 271 tolerance.

272 After adjustment of social demographics, menopausal status, and  
273 lifestyles factors, we found that women with higher BMI reported higher  
274 mental well-being. Body mass index (BMI) was analyzed as a continuous  
275 variable in this study. Exploring the BMI association further, we compared  
276 the changes in anxiety, depression, psychological symptoms, and mental  
277 well-being scores among different BMI categories. The WHO classification  
278 system of BMI was adopted (WHO, 2000). Similarly, we found that women  
279 with a BMI over 30 had significantly higher scores in mental well-being af-  
280 ter 5 years time, when compared with women in the normal ( $p = .003$ )  
281 and overweight ( $p = .030$ ) categories. There was no difference between  
282 women in the normal and overweight category ( $p = .459$ ). In addition, no  
283 difference in anxiety ( $p = .237$ ), depression ( $p = .388$ ), and psychological  
284 symptoms ( $p = .399$ ) was indicated. This relationship is contrasted to the  
285 findings from other longitudinal studies by Kasen and colleagues (2008) and  
286 Roberts and colleagues (2003), who found that women being obese at age  
287 27 years had about a sixfold increased risk of developing depression and  
288 anxiety after three decades. “Appearance concern” is proposed as one of  
289 the pathways by which overweight or obese people experience impaired  
290 psychological functions (Hrabosky & Thomas, 2008; Markowitz, Friedman,  
291 & Arent, 2008). Given that women become more accepting of their bodies  
292 as they age (Keel, Baxter, Heatherton, & Joiner, 2007), our finding may sug-  
293 gest that midlife women are less bothered by weight problems, regardless  
294 of having higher BMIs. To some extent, our results also may indicate that  
295 some women are not fully aware of the risk of chronic diseases if they stay  
296 overweight or obese.

297 In terms of physical activity, although no statistically significant relation-  
298 ship was found between baseline physical activity and future psychological  
299 symptoms and mental well-being, we found a trend toward decreasing anxi-  
300 ety and depression and a positive effect on mental well-being. The Australian  
301 Longitudinal Study on Women’s Health (ALSWH), undertaken by Brown and  
302 colleagues (2005), however, demonstrated a significant relationship between  
303 baseline high level of physical activity and decreasing depressive symptoms  
304 after a 5-year follow-up. The nonsignificant results in our study may be due  
305 to different measures of physical activity and a relatively smaller sample size.  
Q4 306 We noted that both studies measured physical activity through women’s self-  
307 report exercise frequency, yet Brown and colleagues calculated the metabolic  
308 equivalence (MET) to further classify physical activity. It is considered im-  
309 portant that consistency in measuring scales for physical activity are utilized  
310 when conducting future studies.

311 In addition, as Australian women age, they have less depression and  
312 psychological symptoms, and these results are consistent with the ALSWH  
313 study, which found mental health improves in women as they age. These  
314 results show that although women are confronted with considerable biolog-  
315 ical and social changes in conjunction with age at midlife, these events do

316 not necessarily create a “midlife crisis,” because how women perceive aging  
317 depends on their perception of these events and the extent that these events  
318 disrupt their lives. Hunter, Sundel, and Sundel (2002) stated that most women  
319 experience a high level of well-being, life satisfaction optimism, power, and  
320 personal achievement at this stage of life, regardless of the physical health  
321 problems confronting them.

322 Our study has two major strengths. First, it adopted a prospective design  
323 and had a relatively large sample size, which allows the exploration of the  
324 temporal relationship between lifestyle and mental health. This is essential  
325 for clinical practice to identify the first priority of lifestyle in health promo-  
326 tion programs. Second, we cover a number of common lifestyles that have  
327 intercorrelations with one another. This approach avoids the confounding  
328 effect of lifestyles to one another. The limitations of the study include the  
329 measurement of physical activity, which does not measure the intensity and  
330 duration of physical activity. This may limit the ability of reflecting the true  
331 level of physical activity. Second, we assess the frequency of alcohol drink-  
332 ing only. Given that about 75% of women drink alcohol occasionally or  
333 regularly, it may be important to adopt a more comprehensive measure-  
334 ment tool, which enables the researcher to quantify the volume of alcohol  
335 consumption.

### 336 Clinical Implications and Conclusion

337 Through a longitudinal analysis with Australian midlife women, we find that  
338 women with higher BMI have better mental well-being, and women who  
339 drank alcohol in the past currently, have less anxiety. In addition, smoking  
340 and caffeine consumption play a negative role in women’s mental health  
341 as they age. Further research is required to investigate the dose–response  
342 relationship between caffeine consumption and mental health. Also, it is  
343 worthwhile exploring why midlife women with a higher BMI tend to have  
344 better mental well-being.

345 In relation to clinical practice, we suggest that smoking cessation should  
346 be a key component in promoting midlife women’s health. In addition, it is  
347 indicated that nurses also may pay attention to caffeine consumption when  
348 they conduct health education, especially to women. Health professionals,  
349 generally, and mental health professionals, specifically, should emphasize  
350 the importance of the detrimental effect of smoking not only on physical  
351 health but on mental health as well.

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